Docket No.: 65689CPDV(43382)
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ian Hunter *et al.*

Application No.: 10/820,679 Confirmation No.: 8534

Filed: April 8, 2004 Art Unit: 1797

For: METHODS OF LOADING LIQUID SAMPLES INTO THROUGH-HOLE ARRAYS **[AMENDED]** Examiner: A. Soderquist

DECLARATION OF COLIN J.H. BRENAN, PH.D. UNDER 37 C.F.R. § 1.132

1. I, Colin J.H. Brenan, hold a Doctor of Philosophy degree in Biomedical Engineering, a Master of Science degree in Electrical Engineering, and a Bachelor of Science in Physics (with honors), all from McGill University of Montreal, Quebec.

2. I am a co-founder of and am currently the Chief Technology Officer and Senior Vice President of Business Development of BioTrove, Inc. of Woburn, Massachusetts. BioTrove, Inc. is the exclusive licensee of the above-referenced patent application.

3. I am named as a co-inventor with Ian Hunter and Tanya S. Kanigan of the above-referenced patent application. I am familiar with the contents of the application and the prosecution undertaken therein as of the date of this declaration. In particular, I reviewed the Office Action mailed May 5, 2009 ("the Office Action"), the Amendment and Response to Final Office Action Pursuant to 37 C.F.R. § 1.116 filed July 1, 2009, the Advisory Action mailed July 9, 2009 ("the Advisory Action"), and the Amendments to the Claims section of the Amendment and Response to Advisory Action that is to be submitted concurrently herewith.

4. It is my understanding the Office Action rejects claims 1, 3-10, and 12 and alleges that the specification "does not reasonably provide enablement" for (i) any spacing or (ii) addition of the fluid from the top of the stack or a stack arranged with registration of the through-holes in a side to side configuration.

5. I respectfully assert that one of ordinary skill in the art would be enabled by the specification to practice the presently claimed invention for the reasons set forth below.

Through-Hole Array Spacing

6. One of skill in the art would appreciate that the minimum inter-array spacing extends to the smallest dimension greater than zero.

7. One of skill in the art would recognize that the maximum spacing inter-array spacing is the distance at which a pendant droplet detaches from or collapses onto the through-hole array.

8. In a model system depicted below in Figures 1A and 1B, two through-hole arrays separated by distance x are stacked with co-aligned through-holes having diameters d. As pressure is applied to the fluid in the through-hole in the top array, a pendant droplet with radius r extends from the bottom of the through-hole.

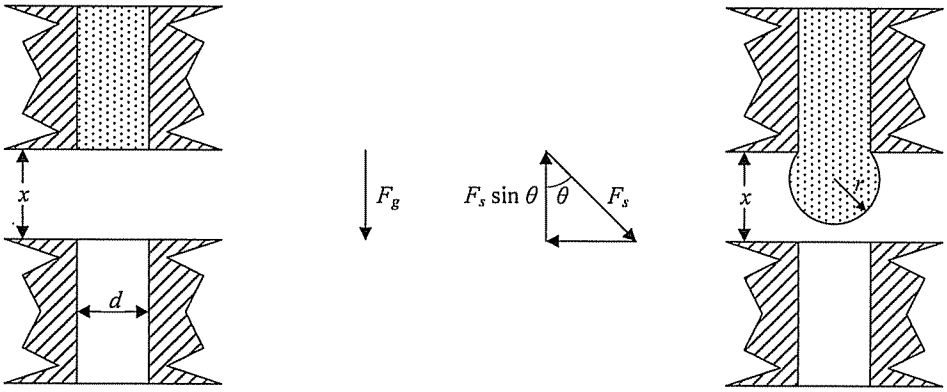

Figure 1A

Figure 1B

9. The pendant droplet will grow until it detaches from the through-hole. This will occur at the point when $F_g = F_s \sin\theta$. F_g represents the gravitational force on the pendant droplet. $F_s \sin\theta$ represents the surface tension force on the pendant droplet opposing gravity.

10. The maximum inter-array spacing x can be calculated in the following manner.

a. The circumference contacted by the liquid is equal to πd.

b. $F_{sN} = \pi d\gamma \sin\theta$, wherein γ represents the liquid surface tension (in N/m), d represents the through-hole diameter (in m), and θ represents the liquid contact angle.

c. $F_g = mg = V\rho g$, wherein V represents the droplet volume (in m^3), ρ represents the liquid density (in kg/m^3), and g represents the acceleration due to gravity (in m).

d. Equating $F_{sN} = F_g$ at the point of detachment ($\theta = 90°$) yields $V = \frac{\pi d\gamma}{\rho g}$.

e. Using $V = \frac{4}{3}\pi r^3$, one of skill in the art can solve the equation in Paragraph 9(d) for $r = \sqrt[3]{\frac{3d\gamma}{4\rho g}}$, which can then be solved for particular through-holes, gravitational forces, coefficients of surface tension and liquid densities for the fluid. For example, assuming $d = 0.28 \times 10^{-3}$ m, $g = 9.8 \frac{m}{s^2}$, $\gamma = 0.038 \frac{N}{m}$, and $\rho = 1{,}000 \frac{kg}{m^3}$, r $\approx$0.933 mm.

f. The maximum inter-array distance $x = 2r$. Therefore, for the parameters specified above, $x \approx$1.868 mm.

Orientation of Stacked Through-Hole Arrays

11. One of skill in the art would appreciate how to utilize the claimed methods to load a stack of through-hole arrays oriented in any direction.

12. The enablement of methods of transferring liquids from the top of a stack to the bottom of the stack was demonstrated in Paragraphs 6-10 herein.

13. As depicted below in Figure 2, the gravitation force F_g on a pendant droplet extending horizontally from a through-hole array having a hydrophobic exterior surface is countered by surface tension forces F_S that pull the pendant droplet to maintain contact with the fluid in the through-hole and repulsive forces F_R that act to push the sagging portion of the pendant droplet away from the hydrophobic surface.

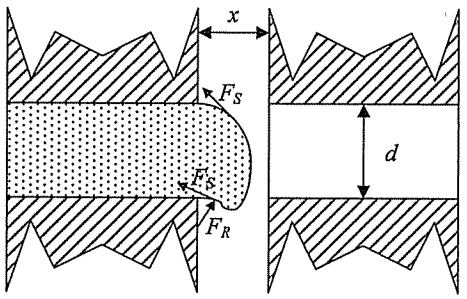

Figure 2A

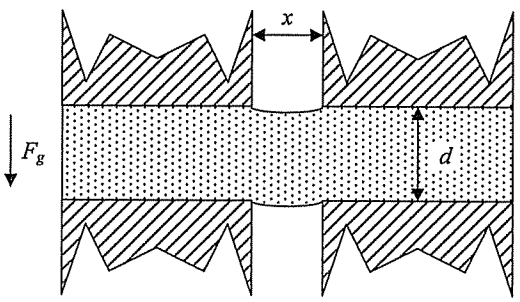

Figure 2B

14. One of skill in the art would recognize that through-hole diameter *d*, inter-array spacing *x*, and the particular coatings used can be modified to load particular samples. Such modifications can be determined experimentally or through the use of the same or similar equations discussed herein.

Conclusion

15. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

November 5, 2009
Date

Colin J.H. Brenan, Ph.D.